Wastewater Reclamation and Reuse

INTRODUCTION

Army installations, like small municipalities, are sometimes faced with potable water shortages, water use restrictions, or wastewater treatment plant effluent limitations that can force them to seek alternative ways of managing their water and wastewater. Reclaiming and reusing treated wastewater instead of releasing it to the environment may be the solution. The term "reclaimed water" typically refers to domestic wastewater that has received at least secondary treatment and basic disinfection and is reused. By reusing the water, we can protect freshwater resources from pollution and reduce overall water consumption.

Water Shortage?

"With many communities throughout the world approaching or reaching the limits of their available water supplies, water reclamation and reuse has become an attractive option for conserving and extending available water supplies."

Source: Guidelines for Water Reuse, EPA

WHY REUSE WATER?

The following are some of the reasons for water reuse.

- ***Conserve and manage potable water supplies by:***
  - using reclaimed water in place of potable water for certain purposes, and
  - augmenting potable water sources (e.g., reservoirs, rivers, groundwater) with reclaimed water.
- ***Protect and conserve the environment by:***
  - decreasing diversion of freshwater from sensitive ecosystems,
  - decreasing discharges to sensitive water bodies,
  - creating constructed wetlands and enhancing stream habitats, and
  - reducing and preventing pollution by reducing effluent pollutant loads.
- ***Comply with environmental regulations and reduce liability by:***
  - better managing water consumption and wastewater discharges to meet regulatory limitations.

USES FOR RECLAIMED/RECYCLED WATER

- ***Urban Reuse.*** Urban reuse can include landscape irrigation, vehicle washing, toilet flushing, and fire protection. The most common urban reuse is landscape irrigation, which can have restricted or unrestricted access. Restricted landscape irrigation can be used in areas where public access is limited (e.g., highway medians) or where water application is controlled to prevent direct contact with people. Unrestricted landscape irrigation, with high quality reclaimed water, can be used on lawns, playgrounds, gardens, public parks, decorative ponds, golf courses, and other places where people might be in contact with the water.

- ***Agricultural Reuse.*** Agricultural irrigation includes restricted and unrestricted uses. Restricted irrigation refers to the use of low-quality reclaimed water in specific areas where only fodder, fiber, and seed crops are grown, such as alfalfa, cotton, and wheat. Public access is not allowed in these growing areas. Unrestricted irrigation refers to the use of high-quality reclaimed water for irrigation of food crops for human consumption.

- ***Potable Water Recharge.*** Reclaimed water can be used to recharge groundwater aquifers via land application, unlined ponds, rapid infiltration basins, or direct injection. It can also be used to recharge potable surface waters via direct or indirect surface water discharge.

- ***Industrial Reuse.*** Industrial uses for reclaimed water include evaporative cooling water, boiler feed water, and process waters.

WATER CONSERVATION AT WHAT EXPENSE?

Water reuse is usually technically feasible, with the systems having the same components as conventional water/wastewater treatment and distribution systems. The primary drawback is cost. Treatment and distribution systems are expensive to construct and usually require ongoing operation, maintenance and repair expenditures. The payback period may not be acceptable to some installations/municipalities.

WHEN DOES WATER REUSE MAKE SENSE?

A reuse system makes sense when one or more of the following conditions are present.

- The life cycle cost of treating/disposing of the wastewater and treating/distributing the water exceeds that of reclaiming and reusing the same amount of water. (Note: A detailed life-cycle cost analysis should be performed when considering water reuse.)

- When regulatory constraints directly (e.g., compliance order to reuse water) or indirectly (e.g., water withdrawal limits are exceeded or effluent flow limits are exceeded at the wastewater treatment plant) mandate reuse.

- When water consumption far exceeds replenishment and depletion is imminent.

FEDERAL REGULATIONS / GUIDELINES

There are no Federal regulations directly governing treated wastewater reuse. However, the U. S. EPA has published a guidance manual on the topic. The document is titled *Guidelines for Water Reuse*. It provides states with recommended guidelines for a wide range of reuse practices. Federal water reuse guidelines are summarized in the table below for three different reuse scenarios. Indirectly, existing federal laws/regulations serve to protect health and the environment with regard to water reuse.

FEDERAL SUGGESTED GUIDELINES FOR THREE COMMON TYPES OF WATER REUSE[1]

Types of Reuse	Treatment	Reclaimed Water Quality	Reclaimed Water Monitoring
Urban Reuse Landscape irrigation, vehicle washing, toilet flushing, fire protection, commercial air conditioners, and other uses with similar access or exposure to the water.	• Secondary[2] • Filtration[3] • Disinfection[4]	• pH = 6 – 9 • ≤ 10 mg/L biochemical oxygen demand (BOD) • ≤ 2 turbidity units (NTU) [6] • No detectable fecal coliform/100 mL [5] • 1 mg/L chlorine (Cl_2) residual (min.)	• pH - weekly • BOD – weekly • Turbidity – continuous • Coliform – daily • Cl_2 residual - continuous
Agricultural Reuse – Non-Food Crops Pasture for milking animals; fodder, fiber and seed crops	• Secondary • Disinfection	• pH = 6 – 9 • ≤ 30 mg/L BOD • ≤ 30 mg/L total suspended solids (TSS) • ≤ 200 fecal coliform/100 mL [7] • 1 mg/L Cl_2 residual (min.)	• pH - weekly • BOD – weekly • TSS – daily • Coliform – daily • Cl_2 residual - continuous
Indirect Potable Reuse Groundwater recharge by spreading into potable aquifers	• Site specific • Secondary and disinfection (min.) • May also need filtration and/or advanced wastewater treatment	• Site specific • Meet drinking water standards after percolation through vadose zone	• pH - daily • Turbidity – continuous • Coliform – daily • Cl_2 residual – continuous • Drinking water standards – quarterly • Other – depends on constituent

Source: Guidelines for Water Reuse (EPA/625/R-92/004, September 1992)

[1] Additional reuse scenarios and guidelines are provided in the referenced document.

[2] Secondary treatment processes include activated sludge processes, trickling filters, rotating biological contactors, and many stabilization pond systems. Secondary treatment should produce effluent in which both the BOD and TSS do not exceed 30 mg/L.

[3] Filtration means passing the effluent through natural undisturbed soil or filter media such as sand and/or anthracite.

[4] Disinfection means the destruction, inactivation or removal of pathogenic microorganisms. It may be accomplished by chlorination, or other chemical disinfectants, UV radiation or other processes.

[5] The number of fecal coliform organisms should not exceed 14/100 mL in any sample.

[6] Turbidity should not exceed 5 NTU at any time.

[7] The number of fecal coliform organisms should not exceed 800/100 mL in any sample.

STATE GUIDELINES/REGULATIONS

Water reuse is regulated on a state-by-state basis, and the development of standards is the responsibility of state agencies. Some states have developed regulations based on the national guidelines, while others have their own. Regardless of location, the following are typical minimum requirements when implementing an urban reuse system, such as golf course irrigation.

TYPICAL REQUIREMENTS FOR IMPLEMENTING AN URBAN REUSE SYSTEM

Laws & Regulations	Federal Guidelines for Water Reuse State specific Water Reuse Regulations	
Regulatory Approval Process	1. Letter of Intent 2. Design Development Report 3. Application for Water Reuse Permit 4. Draft Permit Issued 5. Public Notice/Comment	6. Final Permit Issued 7. Plans and Specs submitted/reviewed 8. Plan of Operation submitted/reviewed 9. Certification of Construction Completion 10. Authorization to commence operation
Treatment Requirements	Coagulation, filtration, and high level disinfection treatment to the following standards: ▪ ≤ 10 mg/L BOD ▪ Turbidity – 2 Turbidity Units (5 NTU max.) ▪ Fecal coliform bacteria - 14 per 100 mL ▪ pH shall be maintained between 6 – 9 ▪ 1 mg/L Cl_2 residual (min.)	
Storage Requirements	Reject Water Storage (3 days) Operational storage (as determined by design engineer)	
Supplemental Facilities Required	Chemical feed facilities for coagulant addition Multiple multimedia filter units with automatic backwashing High level disinfection system with redundancy Pump station(s) Distribution system Operational storage Standby Power	
Monitoring Requirements	BOD (weekly) Turbidity (continuously) TSS after disinfection (frequency as specified in permit) Fecal Coliform bacteria (frequency as specified in permit) pH (weekly) Cl_2 residual (continuously)	
Operation Requirements	Operation of reuse system by certified operators Onsite operation for 6 – 24 hours per day Operation and maintenance of coagulation, filtration, and pumping systems Sample collection and analyses Cross-connection control program Contingency Plan for emergencies and natural disasters	

RECENT EXAMPLE WHERE WATER REUSE WAS INVESTIGATED

As a result of a State requirement to develop a strategy to manage coastal saltwater intrusion, Installation X was partnering with county officials on a comprehensive water supply management plan to assess water demand and water supply sources. Installation X evaluated several water reuse alternatives and compared them to the current practice of using the potable groundwater

supply for all water uses. It was determined that water reuse measures could result in a 6 – 15% reduction in potable water use. The 20-year life-cycle cost of each alternative was estimated and compared with the life-cycle cost of continuing to operate the existing water supply system. The evaluation identified the least costly reuse alternative, but concluded that it was not economically feasible to implement, due to the cost of constructing an additional water distribution system. In this particular case, the installation was not exceeding water withdrawal limits, there was no regulatory mandate for water reuse, and there was no economic benefit; therefore, water reuse was not implemented.

FINAL THOUGHTS

Water reuse is becoming more common and is gaining acceptance among communities and regulatory agencies. The primary drawback is cost, as these systems often require traditional water treatment facilities and separate distribution systems. Golf course irrigation is often at the top of the list of reuse options at military installations and small communities. However, the golf course option often requires treatment to "unrestricted" standards, and often provides only a seasonal solution, with storage or an alternative means of reuse/disposal required during winter months – adding to the cost. Therefore, when considering water reuse, a thorough evaluation of alternatives is necessary to determine the best option - based on technical, regulatory, and economic feasibility.

QUESTIONS/COMMENTS

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Any comments on this newsletter or suggestions for future topics can be relayed to me at extension 3816 or at the following email address: william.fifty@apg.amedd.army.mil For access to past newsletters or other program information, explore our web page (http://chppm-www.apgea.army.mil/swwp/swwp.htm).

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